भारतीय मानक
Indian Standard

IS 636 : 2018

नॉन-पर्कोलेटिंग नम्य अग्नि शामक डिलीवरी होज — विशिष्टि

(चौथा पुनरीक्षण)

Non-Percolating Flexible Fire Fighting Delivery Hose — Specification

(Fourth Revision)

ICS 13.220.10

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Rubber and Rubber Products Sectional Committee, PCD 13

FOREWORD

This Indian Standard (Fourth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Rubber and Rubber Products Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

This standard was originally published in 1958 and subsequently revised in 1962, 1979 and 1988. In the second revision, categorization based on construction was removed and the specification made performance-oriented with classification under two types, depending on differences in the requirements. Type A is the rubber lined or rubberized fabric lined with or without elastomeric coating/covering fire hose which would take care of the more rigorous operational uses and changing fire fighting environment.

In the third revision, the requirements of mass and coil diameter were modified while the requirements for tensile strength and elongation at break of lining, flexibility and friction loss were deleted. Further, requirements for water pick up moisture absorption, ozone resistance and oil resistance test were included for Type B hoses. In third revision, tests were classified as type, acceptance and routine tests, depending upon the criticality and time factor, to facilitate speedy acceptance of lots.

In this revision one more type of hose has been added. Requirements of hot surface resistance and pressure loss have been added to improve quality and strength. Pressure for hydrostatic proof pressure and kink test have been increased to 23 kgf/cm^2. To improve better quality / strength of fire hose, burst pressure has been increased to 38 kgf/ cm^2. Heat resistance test, for Type 1 has been deleted.

This standard contains **6.3** which call for agreement between the purchaser and the supplier.

In the formulation of this standard, assistance has been derived from following International Standards:

BS 6391:2009 ‘Specification for non-percolating layflat delivery hoses and hose assemblies for firefighting purposes’

AS 2792:1992 ‘Fire hose — Delivery layflat’

BS EN 14540 : 2004 ‘Fire-fighting hoses. Non-percolating layflat hoses for fixed systems’

The composition of the Committee responsible for the formulation of this standard is given at Annex K.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*).’ The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

NON-PERCOLATING FLEXIBLE FIRE FIGHTING DELIVERY HOSE — SPECIFICATION

(Fourth Revision)

1 SCOPE

1.1 This standard prescribes requirements and test method for Types 1, 2 and 3 of non-percolating lay flat delivery hoses for firefighting purposes, which are intended for use at working pressures not exceeding 15 kgf/cm^2 of nominal sizes 38, 50, 63 and 70 mm.

NOTES

1 The working pressure of the hoses in service will not normally exceed 8 kgf/cm^2, but they can be used at pressures up to 15 kgf/cm^2, for example when connected to high rise mains.

2 All pressure values specified in this standard are gauge pressures.

3 Annex H gives recommendations for the pressure testing of hoses in service.

4 Annex I specifies the minimum frequency of tests.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to this revisions and parties to agreement based on the standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
397	Methods for statistical quality control during production
(Part 1) : 2003	Control charts for variables
(Part 2) : 2003	Control charts for attributes
443 (Part 1) : 2017/ ISO 7326 : 2006	Methods of test for rubber and plastics hoses: Assessment of ozone resistance under static conditions (*third revision*)
(Part 3) : 2017/ ISO1402 : 2009	Hydrostatic testing (*third revision*)
715 (Part 2) : 1976	Coated abrasives: Part 2 Special and Mechanized applications
3400 (Part 6) : 2012	Methods of test for vulcanized rubber: Part 6 Determination of the effect of liquids
4905 : 2015	Random sampling and randomization procedures (*first revision*)
7503/ISO 1382 : 2012	Glossary of terms used in rubber industry (*second revision*)

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 7503 and the following shall apply.

3.1 Type Tests — Type tests are those tests carried out to determine that the hose design and method of manufacture meet the full requirements of this standard. They shall be repeated whenever the hose construction or the materials are modified, or every five years, whichever occurs first.

3.2 Acceptance Tests — Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

3.3 Routine Tests/Production test — Production tests are those tests to be carried out on every length (that is, roll /coil) of hose manufactured.

4 TYPES

4.1 Hoses shall be of the following three types.

4.1.1 *Type 1 (Uncoated)* — Hoses to which no external treatment has been applied to the reinforcement and are therefore liable to absorb liquids.

NOTE — These need to be thoroughly dried after use.

4.1.2 *Type 2 (Coated)* — Hoses to which an external elastomeric coating has been applied to the reinforcement to give some protection against the absorption of liquids, and to improve resistance to abrasion of the reinforcement and heat.

4.1.3 *Type 3 (Covered)* — Hoses to which an elastomeric outer covering has been applied or incorporated as reinforcement to give the hoses very low absorption of liquids such as oils, greases, acids and alkalis, etc., and high resistance to abrasion and direct heat.

5 TESTS

5.1 Classification of Tests

5.1.1 *Type Tests*

The following shall constitute the type tests:

a) Workmanship (*see* **6.1.3**),
b) Internal diameter (*see* **6.2**),

c) Length (*see* **6.3**),
d) Mass (*see* **6.4**),
e) Coil diameter (*see* **6.5**),
f) Hydrostatic proof pressure (*see* **6.6**),
g) Hydrostatic burst pressure (*see* **6.7**),
h) Kink test (*see* **6.8**),
j) Change in length (*see* **6.9**),
k) Change in diameter (*see* **6.10**),
m) Adhesion (*see* **6.11.1**),
n) Accelerated ageing (*see* **6.11.2**),
p) Abrasion resistance (*see* **6.12**),
q) Water pick up/moisture absorption (for Type 2 and Type 3 only) (*see* **6.13**),
r) Heat resistance (for Type 2 and Type 3 only) (*see* **6.14**),
s) Oil resistance (for Type 3 only) (*see* **6.15**),
t) Ozone resistance (*see* **6.16**), and
u) Hot surface resistance (*see* **6.17**),
v) Pressure loss (*see* **6.18**).

5.1.2 *Acceptance Tests*

The following shall constitute the acceptance tests:

a) Workmanship (*see* **6.1.3**),
b) Internal diameter (*see* **6.2**),
c) Length (*see* **6.3**),
d) Mass (*see* **6.4**),
e) Coil diameter (*see* **6.5**),
f) Hydrostatic burst pressure (*see* **6.7**),
g) Hydrostatic proof pressure (*see* **6.6**),
h) Kink test (*see* **6.8**),
j) Change in length (*see* **6.9**),
k) Change in diameter (*see* **6.10**),
m) Adhesion (*see* **6.11.1**),
n) Abrasion resistance (*see* **6.12**),
p) Heat resistance (for Type 2 and Type 3 only) (*see* **6.14**).

5.1.2.1 A recommended sampling plan for determining the acceptability or otherwise of a lot, is given In Annex A.

5.1.3 *Production/Routine tests*

a) Workmanship (*see* **6.1.3**),
b) Internal diameter (*see* **6.2**)
c) Length (*see* **6.3**), and
d) Hydrostatic proof pressure (*see* **6.6**).

6 REQUIREMENTS

6.1 General

6.1.1 Inner lining shall be of rubber or rubberized fabric lining which is generally smooth and practically free from pitting and other imperfections.

6.1.2 Externally applied elastomeric coating or covering of the reinforcement, if present shall be generally smooth and practically free from pitting and other imperfections.

6.1.3 *Workmanship*

The jacket shall be practically free from dirt, knots, lumps, irregularities of the yarn and other visible defects.

6.2 Internal Diameter

The internal diameter of the hose shall be measured by a suitable conical plug gauge and shall conform to the specified diameter with a tolerance of plus 2 and minus 0.0 mm.

6.3 Length

Unless specified otherwise, the standard length shall be 30 m. Unless otherwise specified, a tolerance of ± 2 percent shall be permitted on the length prescribed for the hose by the purchaser but the total of all lengths of hose supplied shall be not less than the total quantity specified by the purchaser.

NOTE — Other recommended nominal lengths of hoses are 7.5 m, 15 m and 22.5 m.

6.4 Mass

The average mass of hose per meter of 2 m length, without couplings attached, shall not be more than that prescribed in Table 1. For the determination of mass, sample of the hose shall be conditioned at 27 ± 2°C and 65 ± 5 percent relative humidity for a period of at least 48 h and then shall be weighed under the same conditions.

6.5 Coil Diameter

For 30 m length of dry hose without couplings, the coil diameter shall not exceed 45 cm for Type 1, 50 cm for Type 2 and 55 cm for Type 3.

6.6 Hydrostatic Proof Pressure Test

Each hose length shall be subjected to an internal hydraulic

Table 1 Maximum Mass of Types 1, 2 and 3 Hoses
(*Clause* 6.4)

Sl No.	Internal Dia	Mass of Hose Per Meter Length, *Max*		
		Type 1	Type 2	Type 3
(1)	(2)	(3)	(4)	(5)
i)	38	300	315	380
ii)	50	375	395	490
iii)	63	450	480	620
iv)	70	500	550	680

pressure of 23 kgf/cm² in accordance with **8.1** of IS 443 (Part 3) increasing the pressure at the rate not exceeding 10 kgf/cm² per min and maintaining it for 1 min. Within this 1 min, the hose shall neither develop any leakage or sweating, nor shall any thread in the jacket break.

6.7 Hydrostatic Burst Pressure Test

A test length of hose, 1 m clear of fittings when subjected to an internal hydraulic pressure in accordance with **8.3** of IS 443 (Part 3) while increasing the pressure at the rate not exceeding 10 kgf/cm^2 per min shall not burst or show leakage before a pressure of 38 kgf/cm^2 is reached.

6.8 Kink Test

Connect a 3 m length of hose to a suitable hydraulic pump. Blank the free end of hose pipe with a suitable coupling having arrangement to bleed out entrapped air with the help of suitable stop cock or pet cock. Fill the hose with water and raise the pressure to 0.7 kgf/cm^2. Allow all air to escape through stop cock by raising the free end of the hose and again rebuild the pressure to 0.7 kgf/cm^2. Now kink the hose through 180° at approximately 50 cm from the free end by tying the hose back against itself as close to the fitting as practical. Increase the pressure at a rate not exceeding 10 kgf/cm^2/min to 23 kgf/cm^2. When maximum pressure has been attained, retain it for 30 s, release the pressure, and examine it for sign of leakage or damage. There shall be no sign of leakage or rupture and no thread in the jacket shall break.

6.9 Change in Length

The increase in length shall not exceed 6 percent when measured in accordance with **6.9.1**.

6.9.1 Connect the hose to a suitable pump and raise the pressure to 0.7 kgf/cm^2 ensuring that all the entrapped air has been bled out and mark two points not less than 100 cm apart, then raise the pressure to 10 kgf/cm^2 and maintain for minimum 2 min, and measure the distance between the two markings again.

6.10 Change in Diameter

When subjected to a pressure of 10 kgf/cm² in accordance with **6.9.1**, the increase in outer diameter shall not be more than 10 percent of the initial diameter when measured at 0.7 kgf/cm^2.

6.11 Requirements for Rubber Lining and the Outer Coating

6.11.1 *Adhesion*

When tested according to the method described in Annex B, the rate of separation of the lining and the jacket and the rate of separation of the cover and the jacket (Type 3 hose), shall not exceed 25 mm/min.

6.11.2 *Accelerated Ageing Test*

Four numbers of test hose pieces each of 1 m length, shall be conditioned for 120 h at 27 ± 2°C and 65 ± 5 percent relative humidity and shall then be aged for 336 h at 70 ± 2°C. After ageing and bringing back to room temperature, there shall be no tackiness on the surface of the lining or the surface of the cover. Three numbers of aged test pieces each of 1 m length shall then be subjected to burst pressure test in accordance with the method described in IS 443 (Part 3) and shall meet the requirements given in **6.7**. The remaining length of hose shall be used for an adhesion test in accordance with the method described in Annex B, using a load of 2 kg for the lining and 3.5 kg for the cover. For Type 1 and Type 2 hoses, the rate of separation of the lining and the jacket, and for Type 3 hoses, the rate of separation of the cover and the jacket, shall not exceed 25 mm/min.

6.12 Abrasion Resistance

When determined by the method described in Annex C, the average number of cycles completed before bursting of three test pieces, shall not be less than the value specified in Table 2.

Table 2 Abrasion Resistance
(*Clause* 6.12)

Sl No.	Bore Size	Minimum Number of Cycles		
		Type 1 Hose	Type 2 Hose	Type 3 Hose
(1)	(2)	(3)	(4)	(5)
i)	38 mm / 50 mm / 64 mm / 70 mm	50	75	100

6.13 Water Pick Up/Moisture Absorption (for Type 2 and Type 3 Only)

When tested in accordance with Annex D, the amount of moisture absorbed shall not exceed 0.20 kg/m^2 for Type 2 hoses and 0.02 kg/m^2 for Type 3 hoses.

NOTE — The resistance of fire hoses to acids and alkalis has been found to relate to their resistance to moisture absorption, thus Type 3 hoses can be expected to have the greatest resistance to acids and alkalis.

6.14 Heat Resistance

When tested by the method described in Annex E, none of the test samples shall burst at less than 8 s of the application of the hot cube for Type 2 and 20 s for Type 3 hose.

6.15 Oil Resistance Test (for Type 3 Only)

A test piece measuring 1 m in length shall be marked around the circumference at a distance of 60 mm from each end. The test piece shall be kept immersed in an oil bath for 70 h containing oil No 3 specified in IS 3400 (Part 6) and maintained at 50 ± 2°C in such a manner

that both the ends are so clamped that the marks are in level with the surface of oil and the remaining entire length of the test piece within the marks remains completely immersed in oil. At the end of this period, the test piece shall be taken out in such a manner that the portion beyond the marks does not come in contact with the oil. The length shall be laid horizontally and the central fully immersed portion of the hose shall be visually examined for any swelling of rubber, weathering and cracking in the rubber lining.

Test pieces taken from the central (fully immersed) portion of the hose shall then be subjected to an adhesion test in accordance with the method described in Annex B and shall meet the requirements as given in **6.11.1** (for both lining and cover).

6.16 Ozone Resistance

When tested by the method prescribed in IS 443 (Part 1), the lining (for Types 1, 2 and 3) and cover (for Type 3 only) of the hose shall neither develop cracking nor crazing when seen under X2 magnification, except at the cut edges of the hose.

6.17 Hot Surface Resistance

When tested in accordance with Annex F, at a test temperature of, at a test temperature of 300 ± 10°C for Types 1 and 2, and 400 ± 10° C for Type 3, in none of the four tests shall the test piece show signs of leakage within 120 s from the application of the filament rod or on removal of this filament rod after the specified period.

6.18 Pressure Loss

When tested in accordance with Annex H, the pressure loss per 23 m length shall not exceed the values specified in Table 3 at the specified flow rate and inlet pressure (Recommendations for pressure testing of hoses in service are given at Annex G).

7 MARKING

7.1 Marking

Each length of hose shall be clearly and indelibly marked with the following information:

a) Type of the hose,
b) Size of the hose,
c) Length of the hose,
d) Manufacturer's name or trade-mark or both, and
e) Month and year of manufacture.

7.2 BIS Certification Marking

Each length of hose may also be marked with the Standard Mark.

7.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards* Act, 2016 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

8 TIME LAPSE BETWEEN RECEIPT OF MATERIAL AND TESTING

8.1 For all test purposes, the minimum time between vulcanization and testing shall be 16 h.

8.1.1 For product tests, whenever possible, the time lapse between vulcanization and testing should not exceed 4 months. In other cases, tests shall be made within 2 months from the receipt of the product by the consumer.

8.1.2 Recommended frequency of testing is given at Annex J.

Table 3 Pressure Loss

(*Clause* 6.18)

Sl No.	Size mm	Inlet Pressure Bar	Flow Rate Litre per minute	Maximum Pressure Loss/ 23 m bar
(1)	(2)	(3)	(4)	(5)
i)	38	7	180	0.75
ii)	50	7	225	0.40
iii)	63	7	450	0.50
iv)	70	7	450	0.40

NOTE — 1 bar = 1.019 725 kgf/cm^2.

ANNEX A

(*Clause* 5.1.2.1)

SAMPLING OF FIRE FIGHTING HOSES

A-0 GENERAL

A-0.1 The object of testing hoses by the purchaser is to ensure conformity to the specification, whereas testing by the manufacturer during production is to ensure the conformity by reducing the quality fluctuations to the minimum and thus ensure the conformity of the lot to the specified requirements. A useful guidance can be obtained from IS 397 (Part 1) and IS 397 (Part 2) for the purpose of ensuring the homogeneity of the lot.

A-1 SCALE OF SAMPLING

A-1.1 Lot

In a single consignment, all the lengths of fire fighting hoses of same type, size and produced under similar conditions of manufacture, that is, from single batch of raw material or from components obtained from single source of production or undergoing a single curing process, shall be separated to constitute a lot.

A-1.2 For ascertaining the conformity of the material in the lot to the requirements of the specification, tests shall be carried out on the samples taken from each lot separately.

A-1.3 The number of lengths of hoses to be selected from each lot, for this purpose, shall depend on the size of the lot and shall be in accordance with Table 4.

A-1.3.1 The required number of lengths of hoses shall be selected at random from the lot. In order to ensure the randomness of selection, procedure given in IS 4905 may be followed.

A-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

A-2.1 The lengths of hose selected according to col 1 and 2 of Table 4 shall be examined for visual and dimensional requirements given in **4.1**, **6.1.3**, **6.2**, **6.3**, **6.4** and **6.5** of the specification. A length of hose failing in any one or more of these requirements shall be considered as defective. The lot shall be considered as satisfying these requirements, if the number of defectives found in the sample is less than or equal to the corresponding permissible number of defectives given in col 3 of Table 4.

NOTE — For the purpose of Acceptance test, if mass of the hose per meter is within the limit at 27 ± 2 °C, then there is no need to condition the hose at 65 ± 5 percent relative humidity. (*see* **6.4**)

A-2.2 The lot having been found satisfactory according to **A-2.1** shall be subjected to destructive tests given in **6.7**, **6.8**, **6.9**, **6.10**, **6.11.1**. For this purpose, the number of lengths of hoses given in col 4 of Table 4 shall be selected from the lot. These may be selected from those already tested according to **A-2.1** and found satisfactory. The test specimens of requisite dimensions shall be cut from each sample hose thus selected.

A-2.2.1 The lot shall be considered as conforming to the requirements of these characteristics, if all the lengths of hoses subjected to various destructive tests satisfy the relevant specification requirements.

NOTE — In case cutting of the test pieces from a length of hose is found to be uneconomical or impractical, or when hoses are bound with end fittings, the required number of test pieces may be produced by the same process by which the hoses in the lot have been manufactured and supplied separately along with the lot for testing purpose.

A-2.3 The lot shall be declared as conforming to the requirements of the specification if **A-2.1** and **A-2.2** are satisfied.

Table 4 Scale of Sampling

(*Clause* A-2.1)

Sl No.	Lot Size (in Lengths)	Sample Size for Visual and Dimensional Requirements	Permissible No. of Defective Lengths	Sub-Sample Size
(1)	(2)	(3)	(4)	(5)
i)	Up to 100	10	1	1
ii)	101 to 200	20	2	1
iii)	201 to 300	30	3	1
iv)	301 to 400	40	4	1
v)	401 to 500	50	5	1
vi)	501 and above	80	5	2

ANNEX B

(*Clauses* 6.11.1, 6.11.2 *and* 6.15)

METHOD OF TEST FOR DETERMINATION OF ADHESION STRENGTH

B-1 TEST PIECE

B-1.1 The test piece shall be a cylindrical section of the hose, 25.0 ± 0.5 mm long, cut perpendicular to the axis of the hose with a sharp tool.

B-2 APPARATUS

B-2.1 Mandrel, which is a snug fit in the test piece, with a central shaft.

NOTE — The material of mandrel may be teak wood and that of central shaft may be stainless steel.

B-2.2 Means of Supporting the Mandrel, so that it can rotate in an essentially friction-free manner on its shaft.

B-2.3 Means of Applying a Load to the Test Piece, incorporating a grip for attachment to the lining or cover and a spring for supporting weights, serving as a cushion so as to protect the test piece from receiving jerks and impulses. A typical layout of the test apparatus is given in Fig. 1.

B-3 PROCEDURE

B-3.1 Lining/Reinforcement Adhesion

Turn the test piece inside out, to expose the lining and separate the lining and reinforcement just sufficiently to enable the grip to be attached. Slide the test piece on to the mandrel and insert in the apparatus. Attach the grip together with weights to give a total mass of 2.5 kg and then measure the length of lining separated after 1 minute.

B-3.2 Cover Reinforcement Adhesion

For Type 3 hoses, repeat the procedure described in **B-3.1** using a separate test piece, but test the cover adhesion without reversing the test piece and apply a total mass of 4.5 kg.

B-4 TEST REPORT

B-4.1 The test report shall include the following information:

a) The date of test.
b) All details necessary for the complete identification of the hose under test.
c) The length of separation, if any, after 1 min.

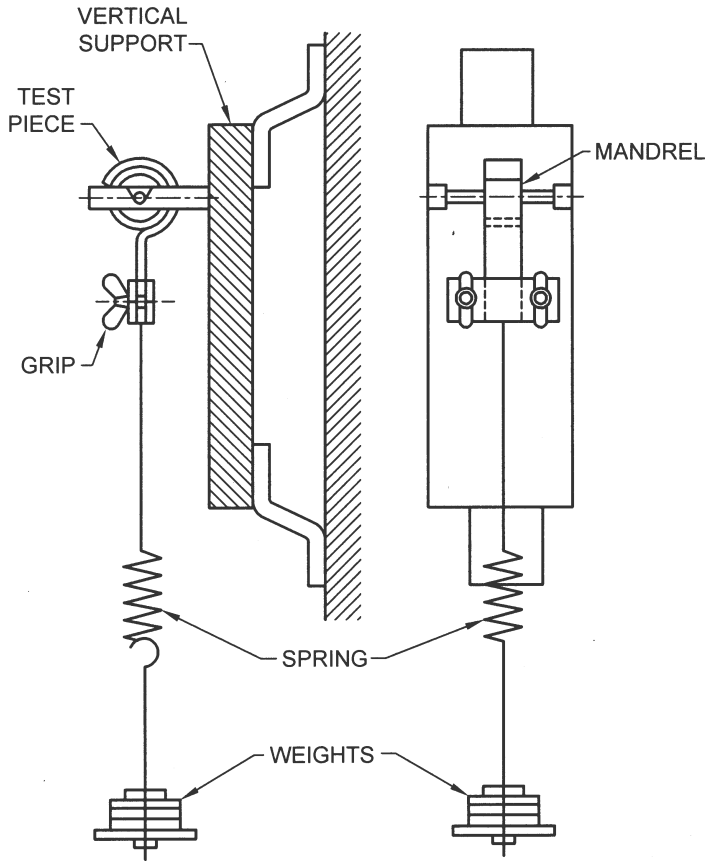


FIG. 1 TYPICAL APPARATUS FOR THE ADHESION TEST

ANNEX C

(*Clause* 6.12)

ABRASION RESISTANCE TEST

C-0 OUTLINE OF THE METHOD

In this test, capability of the hose to withstand the rough usage to ground which it is bound to be subjected to during fire operation is tested. The hose may be dragged on rough surfaces, or bent when it comes in contact with building corners or when the first length from the delivery pump touches the ground and is subjected to continuous chafing due to vibration of the pump.

C-1 APPARATUS

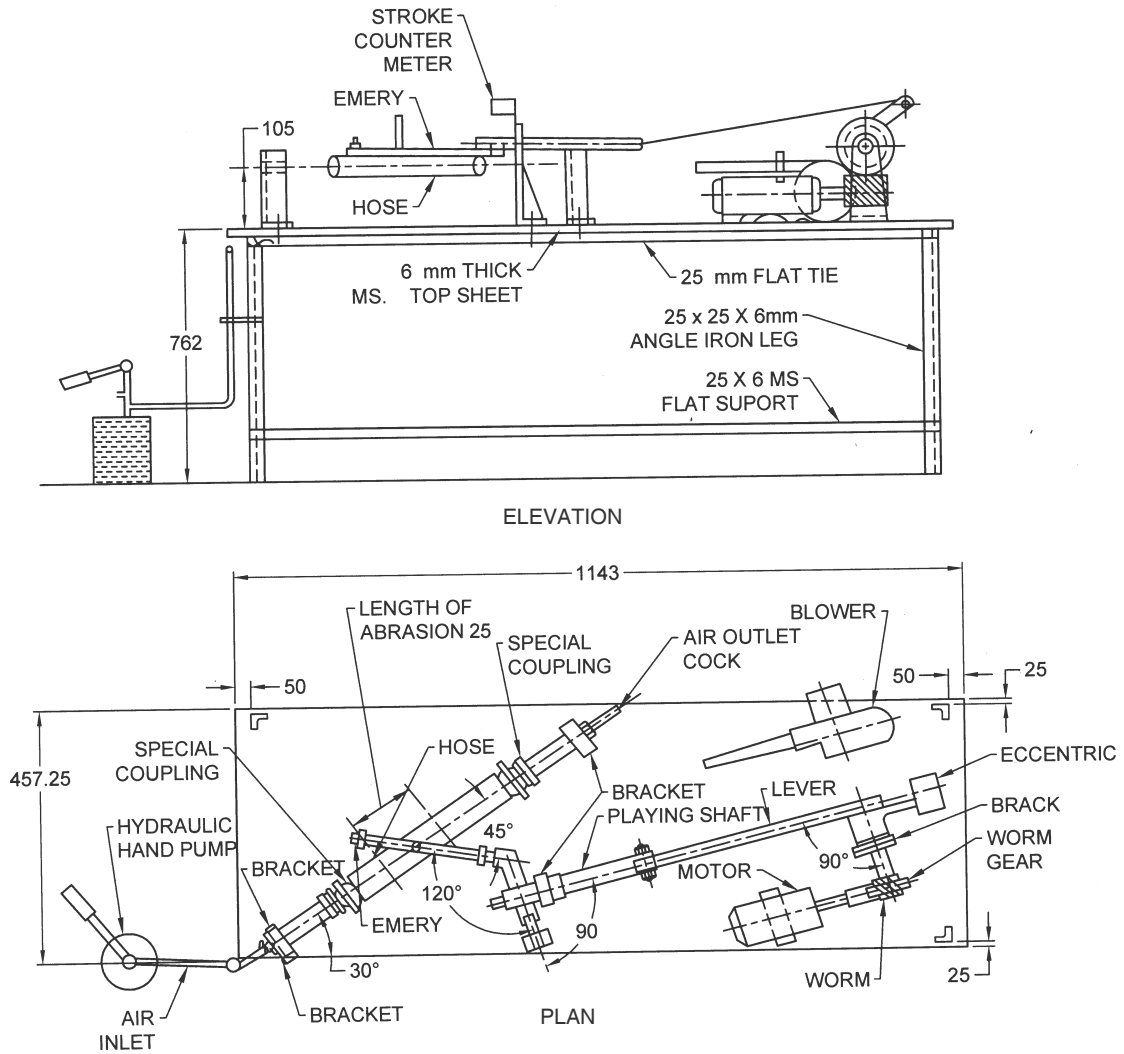
C-1.1 For determining a realistic value of abrasion resistance of the hose, a special apparatus is used as described in **C-1.2**. The average number of cycles completed before the test piece bursts is to be termed as abrasion resistance cycles. Three test pieces shall be taken for such test and the average number of cycles determined.

C-1.2 Test Apparatus

A test apparatus shall be fabricated comprising the following:

a) A constant and uninterrupted source of hydrostatic pressure with water as test medium, capable of maintaining a steady pressure of 7 kgf/cm^2 in the test piece and provisions to bleed out entrapped air.

b) A machine for abrading the test piece with a reciprocating movement. A typical lay out of the test apparatus is given in Fig. 2.



All dimensions in millimetres.

FIG 2 GENERAL ARRANGEMENT OF ABRASION TESTING MACHINE (NTS)

c) Abrasive material fixed on the test apparatus. The abrasive material shall be a strip 25mm wide and 300 ± 5 mm long; grit 50 'X' weight, glue bonded aluminium oxide cloth in accordance with IS 715 (Part 2). A new abrading strip shall be used for each test.

d) An electric air blower to blow away the abraded fluff.

C-2 TEST SPECIMENS

C-2.1 Test Piece

Cut pieces of 35cm length of hose.

C-2.2 Number of Test Pieces

Three test pieces shall be subjected to abrasion resistance test.

C-3 PROCEDURE

C-3.1 The abrading strip shall be mounted in a carrier and shall be set at an angle of 45° to the horizontal axis of the test piece and at an angle of 20° to the direction of reciprocating action of the test machine. The apparatus shall be adjusted to give a frequency of 50 to 60 cycles (double strokes) of reciprocating movement per minute. The length of each single stroke shall be adjusted to 230 mm. The machine shall exert a downward force of 1.58 kgf (15.5 N) on the test piece.

C-3.2 Connect the test piece to the pressure source by suitable means.

C-3.3 Fill up the test piece with water at a low pressure to expel all air. Apply a pressure of 7 kgf/cm^2 raised gradually. Test piece should be horizontal as any curved fixing may lead to lower values/results.

Care shall be exercised to ensure that the hose test piece is fixed on the bed of the machine in such a manner that the free end may stretch fully and this pressure of 7 kgf/cm^2 should be maintained for minimum 2 min before starting the abrasion. Care shall also be exercised to ensure that the abrading strip does not abrade the hose test piece at the lap joint, otherwise false results will be obtained on the much higher side.

C-3.4 Switch on the air blower and start the test machine. Record the number of cycles completed until the test piece bursts. The recording of cycles should be done by a metering device such as a stroke counter and it should be switched off as soon as the hose bursts.

C-3.5 Repeat the test with a new abrading strip fixed on the machine, and a new test piece, three times.

C-3.6 Take the average value for three test pieces.

C-3.7 Remove any dirt or debris from the plane of abrasion by using an ordinary air blower, working at a low pressure of 100 kPa and the nozzle fixed to some firm object, directing the air jet at an angle from a distance not exceeding 300 mm.

ANNEX D

(*Clause* 6.13)

METHODS OF TEST FOR MOISTURE ABSORPTION

D-1 TEST PIECE

The test piece shall be 600 mm length of hose marked around the circumference at a distance of 50 mm from each end.

D-2 APPARATUS

D-2.1 Forced circulation air oven capable of being controlled at 50 ± 1°C.

D-2.2 Water bath, filled with distilled water, capable of being controlled at 20 ± 5°C.

D-3 CONDITIONING

Condition the test piece in the oven at 50 ± 1°C for 3 h immediately prior to testing and test it at room temperature.

D-4 PROCEDURE

D-4.1 Weigh the conditioned test piece to an accuracy of 0.1 g.

D-4.2 Fold the test piece inside the marks so that the ends are vertical.

D-4.3 Place the test piece in the water bath, maintained at 20 ± 5°C, and clamp the ends of the test . piece so that the marks are in level with the surface of the water and the entire length of test piece within the marks is immersed

D-4.4 After a period of 6 h, remove the test piece from the water, wipe the surface dry with an absorbent cloth and allow it to dry by hanging vertically at 27 ± 2°C for 2 h and then weigh.

ANNEX E

(*Clause* 6.14)

METHODS OF TEST FOR HEAT RESISTANCE

E-1 TEST PIECE

E-1.1 Each test piece shall be 1 m length of hose freshly cut from the lot offered for inspection. There shall be 3 number of test pieces for this test.

E-2 APPARATUS

E-2.0 The following test apparatus is required:

E-2.1 Laboratory furnace capable of being controlled at 600^{+10}_{-0} °C

E-2.2 A number of steel cubes of uniform size, each side being 13.0 ± 0.1 mm.

E.2.3 Source of steady hydrostatic pressure with water as the test medium. The pressure shall be maintained at 7 kgf/cm² in the test piece, without any variation in the pressure.

E-2.4 A stop watch with a least count of 0.2 s.

E-2.5 A pair of steel tongs of size 30 cm.

E-2.6 A stout guard made of steel wire mesh to protect the person(s) conducting the test.

E-3 TEST PROCEDURE

E-3.1 Place the steel cubes in the furnace at 600^{+10}_{-0} °C and maintain this temperature for at least 30 min immediately before use.

E-3.2 Connect the hose test piece to the pressure source and fill the test piece with water at a low pressure not exceeding 0.7 kgf/cm², to expel all the air from inside the test piece with the help of a pet cock. Place the test piece horizontally on some hard smooth surface like RCC or a metal table. Put the free end of the test piece inside the guard. Apply the water pressure gradually raising it up to 7 kgf/cm².

E-3.3 Take out the heated steel cube from the furnace with the help of an iron tong as quickly as possible (maximum time lapse 2 s) and place it immediately on top of the test piece. The steel cube shall be held in position by means of a light wire support. Record the time elapsed from the time of placing the steel cube on the test piece till the test piece bursts. Repeat the test for all the 3 test pieces. Burst shall not occur within 6 s of the application of the steel cube on any of the test pieces for Type 2 and 20 s for Type 3.

Care shall be exercised to ensure that the hot cube is not placed on the lap joint, otherwise false results will be obtained on the much higher side. For each test, only new mild steel cubes, free from rust, carbon particles and loose flakes, shall be used.

NOTE — In case of polymeric coated hoses, the hot cube has a tendency to slip down due to quick melting of the polymer coating. So the cube must be held in position by means of a light wire support.

ANNEX F

(*Clause* 6.17)

METHOD OF TEST FOR HOT SURFACE RESISTANCE

F-1 TEST PIECE

F-1.1 0.5 m length of hose, marked in four places at approximately 90° intervals circumferentially, three of the marks being coincident with the flat edges of the hose.

NOTE — This sampling procedure is designed to eliminate eccentric covers.

F-2 APPARATUS

F-2.1 Filament rod, consisting of an electrically heated spiral resistance wire with a resistance of approximately 80 Ω wound around a ceramic tube of diameter 21 mm, enclosed in a tube of quartz glass containing a mass fraction of at least 95 percent of SiO_2 (silicon dioxide) and fitted with a brass sleeve (*see* Fig. 1). An example of the design is given in Fig. 2.

F-2.2 Temperature controller and recorder, capable of restoring the set temperature within 15 s of commencement of the test and maintaining the set temperature within the specified limits.

F-2.3 Thermocouple, Type J or Type K (That is not twisted together), jacketed type diameter of 1.5 mm.

F-2.4 Loading weight, designed to press the filament rod against the vertically mounted test piece with a force (F) equivalent to 4 N (*see* Fig. 3).

F-2.5 Cabinet or small enclosure, to eliminate local air movement in the vicinity of the test piece and filament rod.

F-3 PROCEDURE

F-3.1 Couple the test piece in a vertical position, fill it

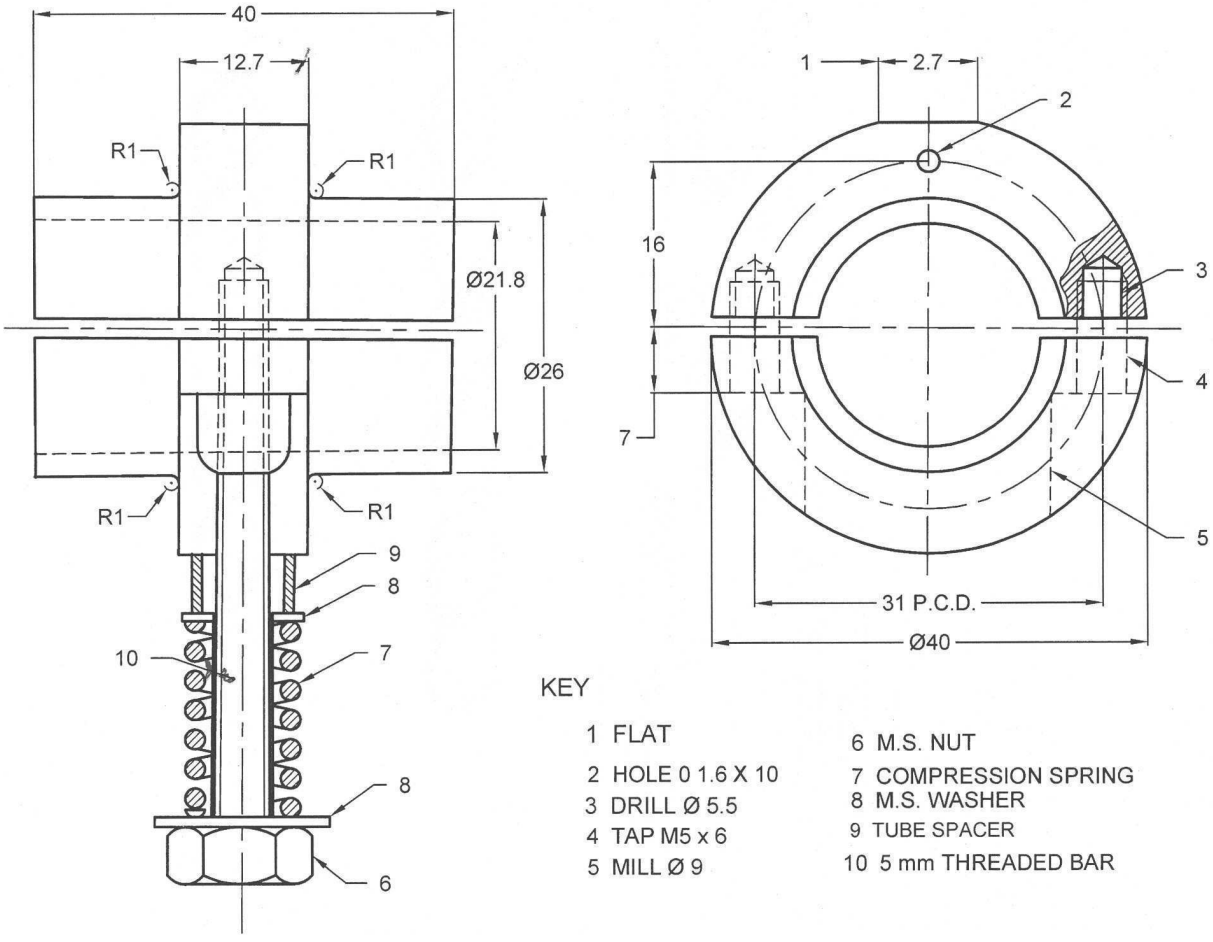


FIG. 3 DETAILS OF BRASS METAL SLEEVE

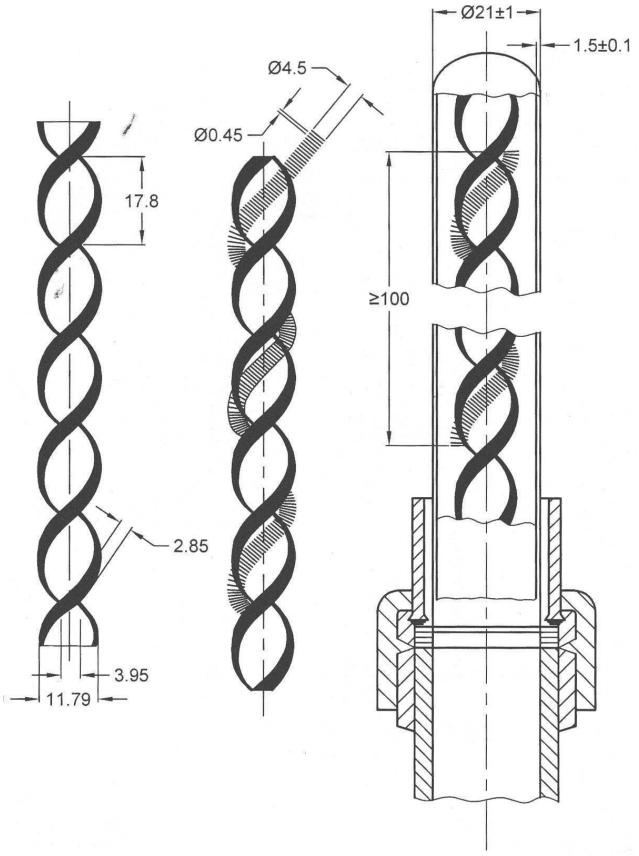
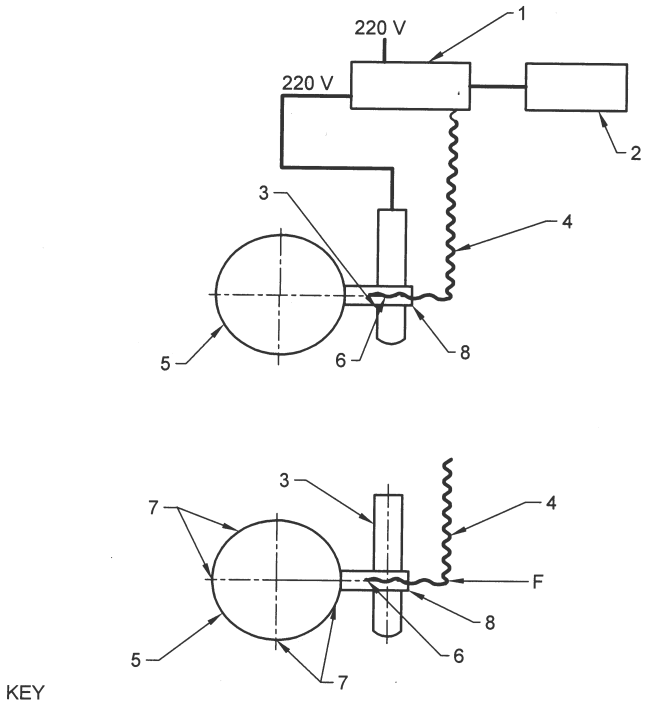


FIG. 4 EXAMPLE OF A SUITABLE FILAMENT DESIGN



KEY

1	TEMPERATURE CONTROLLER	5	HOSE
2	RECORDER OR COMPUTER	6	POINT OF MEASURING
3	FILAMENT ROD	7	TESTING AREAS
4	THERMOCOUPLE, TYPE J OR K	8	METAL SLEEVE

FIG. 5 POINT OF CONTACT OF FILAMENT ROD WITH HOSE (FROM ABOVE)

with water at a test temperature of 15°C ± 5°C, expelling all air and subject it to a pressure of 7 kgf/cm^2.

F-3.2 At ambient temperature, adjust the test piece and the sleeve on the filament rod such that the flat side of the sleeve is in contact with one of the marks on the test piece.

F-3.3 Swing the filament rod away from the test piece, switch on the temperature controller and adjust to the test temperature specified in **6.17**. Maintain and record the test temperature throughout the tests.

F-3.4 Press the filament rod against the mark on the test piece with a force of 4 N.

F-3.5 After 120 s, remove the rod and examine the test piece for leaks.

F-3.6 If a leak occurs in less than the specified time period, stop the test and record the time to failure.

F-3.7 If no leak occurs, repeat the test at the further three marked test positions, after ensuring that the sleeve contact area is clean.

ANNEX G

(*Clause* 6.18)

RECOMMENDATIONS FOR PRESSURE TESTING OF HOSES IN SERVICE

G-1 Once in service, a hose should be hydrostatically tested at 12 month intervals and after each occasion of operational use. The hose should be tested at a pressure 50 percent in excess of the intended working pressure or at 10 kgf/cm^2, whichever is the greater, and maintained for 1 min. If the hose shows any sign of leakage, it should be repaired and retested. If it cannot be satisfactorily repaired, it should be discarded.

ANNEX H

(*Clause* 6.18)

METHOD OF TEST FOR PRESSURE LOSS

H-1 PRINCIPLE

A straight length of hose is subjected to a given pressure and flow and the pressure loss due to friction is then calculated.

H-2 TEST PIECE

Straight length of hose, approximately 23 ± 0.2 m, complete with couplings and adaptors tapped for pressure measuring connections, and connections such as to minimize turbulence (thus reducing errors in pressure measurement).

NOTE — A differential pressure gauge may be used instead of a single pressure gauge at hose assembly inlet and outlet adaptors.

H-3 APPARATUS

H-3.1 A hydraulic test rig, which can pressurize the hose assembly test piece to 7 kgf/cm^2 and maintain the flow rate given in Table 3.

H-3.2 Suitable coupling adaptors, for this required application and sizes of hose.

H-3.3 A variable flow rate branch pipe or monitor, to achieve the required flow rate.

H-4 PROCEDURE

H-4.1 Maintain the pressure at the inlet end at 7 ± 0.35 kgf/cm^2.

H-4.2 Maintain the flow rate as given under Table 3 within ± 2 percent.

H-4.3 Ensure the hose assembly is in a straight line and measure the exact length of the hose assembly at the pressure and flow rate given in Table 3. Use the length to calculate the pressure loss.

H-4.4 Record the pressure loss as the difference between the pressure at the inlet and the outlet end of the test piece.

H-4.5 Calculate the pressure loss per 23 m length.

ANNEX J

(*Clause* 8.1.2)

MINIMUM FREQUENCY OF TESTING

J-1 The minimum frequencies for the tests specified in this standard shall be as specified in Table 5.

Table 5 Minimum Frequency to Testing
(*Clause* J-1)

Sl No.	Name of The Test	Clause No.	Type Test	Acceptance Test	Routine/Production Test
1.	Workmanship	6.1.3	√	√	√
2.	Internal Diameter	6.2	√	√	√
3.	Length	6.3	√	√	√
4.	Maximum Mass	6.4	√	√	
5.	Coil Diameter (Machine Coiled)	6.5	√	√	
6.	Hydrostatic Proof Pressure Test	6.6	√		√
7.	Hydrostatic Burst Pressure Test	6.7	√	√	
8.	Kink Test	6.8	√	√	
9.	Change in Length	6.9	√	√	
10.	Change in Diameter	6.10	√	√	
11.	Adhesion Test	6.11.1	√	√	
12.	Accelerated Ageing	6.11.2	√		
13.	Abrasion Resistance	6.12	√	√	
14.	Water Pick Up/Moisture Absorption	6.13	√		
15.	Heat Resistance	6.14	√	√	
16.	Oil Resistance	6.15	√		
17.	Ozone Resistance	6.16	√		
18.	Hot surface resistance	6.17	√		
19.	Pressure Loss	6.18	√		

ANNEX K

(*Foreword*)

COMMITTEE COMPOSITION

Rubber and Rubber Products Sectional Committee, PCD 13

Organization	*Representative(s)*
Rubber Board, Kottayam	Shri N. Rajagopal (***Chairman***)
All India Rubber Industries Association, Mumbai	Shri D. J. Bharucha Shri Amlesh Roy (*Alternate*)
Apollo Tyres Ltd, Kerala	Dr. Arup K. Chandra Shri T. D. Varkey (*Alternate*)
Association of Planters of Kerala, Thirupuram	Shri A. Jacob
Automotive Tyres Manufacturers Association (ATMA), New Delhi	Shri Vinay Vijayvargia Shri Vijay Sethi (*Alternate*)
Central Revenues Control Laboratory (Ministry of Finance, Department of Revenue, Central Board of Excise & Customs), New Delhi	Shri Suneel Mathur
Dow Corning India Pvt Ltd, Mumbai	Shri Subhranshu Gupta
Export Inspection Council of India, Ministry of Commerce & Industry, New Delhi	Shri K. J. Srivastava Shri S. K. Saxena (*Alternate*)
Flame Retardants Association of India, Gurugram	Shri Murali Mohan
GRP Limited, Mumbai	Shri Mehul Patel Shri Kalyan Das (*Alternate*)
HASETRI, Rajasamand, Rajasthan	Dr. Saikat Das Gupta
HLL Lifecare Limited, Thiruvananthapuram	Shri H. U. Kantharaju
Indian Rubber Manufacturers Research Association, Thane	Shri K. Rajkumar
KA-prevulcanized Latex Pvt Ltd, Nagercoil	Dr. R. K. Matthan Shri Joseph John (*Alternate*)
LPG Equipment Research Centre, Bengaluru	Shri P. Krishnan Kutty Shri R. Rajkumar (*Alternate*)
Ministry of Defence (DGQA), New Delhi	Shri S. K. Saxena Shri V. K. Chhabra (*Alternate*)
Phoenix Yule (P) Ltd, Kolkata	Shri Soumitra Ganguli Shri Asok Kumar Ghosh (*Alternate*)
Reliance Industries Ltd (Elastomers Business), Vadodara	Shri Bharat B. Sharma
Rubber Board, Kottayam	Dr. Siby Varghese
Research, Designs & Standards Organization, Lucknow	Shri Suraj Singh
Voluntary Organization in Interest of Consumer Education (VOICE), New Delhi	Shri M. A. U. Khan Shri H. Wadhwa (*Alternate*)
BIS Directorate General	Shri A. K. Bhatnagar, Scientist 'F' and Head (PCD) [Representing Director General (*Ex-officio*]

Member Secretary
Shri Chandrakesh Singh
Scientist 'C', BIS

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